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PATENT SPECIFICATION

NO DRAWINGS

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COMPLETE SPECIFICATION

Improvements in or relating to Dry Cleaning

We, LAPORTE CHEMICALS LIMITED, a British Company, of Kingsway, Luton, Bedfordshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to improvements in or relating to dry cleaning and more particularly to the reduction or prevention of corrosion of certain metals commonly used in dry cleaning apparatus. These metals are copper, brass, mild steel and galvanised mild steel.

Experience has shown that the corrosion often occurs on parts of dry cleaning apparatus made of the above metals. Sections of the apparatus most particularly affected are the still, condenser, cleaning cage and water separation units. This is believed to be due to one of three factors:—

(1) The use of chlorinated solvents, particularly perchloroethylene.
(2) the use of detergents.
(3) acidity in the garments to be cleaned.

It is believed that any one of the above three factors may cause corrosion, difficulties of this kind being met in several cases where only one of the above three factors applies. Thus, the attack on such metals is often increased when many commonly used dry cleaning detergents are added to the system, for instance in the high charge system of dry-cleaning: in this system a solution of detergent and water is completely solubilised in the solvent. This increased attack may be due to enhanced decomposition of the dry cleaning solvent or to the chemical breakdown of the detergent or other auxiliaries used in the system.

The "high charge system" is referred to in "Dry Cleaning Technology and Theory" by Fulton, and Martin, 1955.

It has now been found according to this invention that if a quantity of an organic boron compound is dissolved in the system this attack may be inhibited. The organic boron compound may be introduced in either or both of two ways. A boron compound may be used which is soluble in the organic dry cleaning solvent which is present, for this purpose an organic ester of boric acid can be used or, where a detergent is to be used in the system, a boron compound soluble in the detergent is used; the detergent will itself be soluble in the organic dry cleaning solvent. Examples of organic boron compounds which can be dissolved in a detergent are organic esters of boric acid, for example tristearyl borate, trihexylene glycol diborate, tri-diisobutyl carbinyl borate, tri-*n*-butyl borate and/or partial esters of boric acid, for example sodium sorbitol borate, potassium sorbitol borate, sodium hexylene glycol borate, sodium glyceryl borate, sodium polyethylene glycol borate.

Accordingly the present invention provides a dry cleaning process which is carried out, in an apparatus having one or more internal surfaces of, or including, copper, brass, mild steel or galvanisd steel, wherein a dry cleaning liquid is used which comprises an organic dry cleaning solvent and at least one organic boron compound.

As stated above an organic ester of boric acid may be used and this dissolved in the organic dry cleaning solvent or a boron compound can be used which is soluble in the detergent which is itself soluble in the organic solution, for this purpose a partial ester of boric acid, for example one of those listed above, can be used. It is also possible to use an organic ester of boric acid instead of or in addition to the partial ester.

It is prefered to use a 1 to 4, preferably 2% solution of the ester and/or partial ester in the detergent and to add this to the organic dry cleaning solvent.

Quantities of boron found suitable for pro-

viding some corrosion inhibition range from 2 p.p.m. to 500 p.p.m. and preferably 2 p.p.m. to 50 p.p.m., based on the total weight of the organic solvent used.

It will be appreciated that whereas the amount of boron compound added to the system is based on the total weight of organic solvent present as indicated above, the concentration at any given moment in a typical non-flam wholly enclosed plant will vary due to the various processes of distillation and cleaning which are taking place simultaneously wtihin any given unit.

When the boron compounds are used with a dry cleaning detergent present, it has been found that they exert their inhibiting influence most effectively in the dry cleaning solvent system in the liquid and in the vapour phase when the detergent is formulated to have a pH value of from 6 to 10, preferably 7.5 to 8.5, such pH being determined as follows: 2.5 ccs. of conductivity water are added to sufficient detergent to give 6.5 gms. of active ingredients, and this is dissolved in perchloroethylene to give a total volume of 40 ccs. The pH of this solution is then measured with a glass electrode and standard calomel reference cell.

The present invention also provides a corrosion-inhibiting composition for use in the process of the invention and comprising a liquid dry cleaning detergent having a pH of from 6 to 10 when determined as herein described, and having dissolved therein one or more esters and/or partial esters of boric acid to a total of 1 to 4% by weight.

Typical results of experimental assessment of corrosion inhibition are given in the following Table. For this test, pieces of copper sheet, mild steel and galvanised mild steel of approximate surface area 10 sq. cm. were immersed in perchloroethylene containing a typical dry cleaning detergent and boiled under reflux for 16 hours. The detergent contained as active ingredients petroleum sulphonate, potassium dodecyl benzene sulphonate and a nonyl phenol ethylene oxide condensate. The detergent was added to give a total of 7% of active ingredients calculated on the volume of solution, a concentration much greater than generally used in order to accelerate the corrosion effect.

TABLE

p.p.m. Boron	Inhibitor	% wt. loss of metal		
		Copper	Mild Steel	Galvanised mild steel
None		0.3%	0.07%	0.47%
35	tri *n*-butyl borate	0.1%	0.03%	0.14%
20	Potassium sorbitol borate	0.04%	0.004%	0.11%
50	Sodium glyceryl borate	nil	0.002%	0.04%
20	Sodium sorbitol borate	nil	0.03%	0.01%
20	7 p.p.m. of boron as tristearyl borate plus 13 p.p.m. of boron as potassium sorbitol borate	0.006%	nil	nil

WHAT WE CLAIM IS:—

1. A dry cleaning process which is carried out, in an apparatus having one or more internal surfaces of, or including, copper, brass, mild steel or galvanised steel, wherein a dry cleaning liquid is used which comprises an organic dry cleaning solvent and at least one organic boron compound.

2. A process as claimed in claim 1, wherein the organic boron compound is an organic ester of boric acid and is dissolved directly in the organic dry cleaning solvent.

3. A process as claimed in claim 1, wherein the organic boron compound which is an organic ester or partial ester of boric acid, is first dissolved in a liquid dry cleaning detergent and this solution dissolved in the organic dry cleaning solvent.

4. A process as claimed in claim 3, wherein the dry cleaning detergent has a pH of from 7.5 to 8.5, when determined as herein described.

5. A process as claimed in any of the preceding claims, wherein 2 to 500 p.p.m. of the

boron is used based on the total weight of organic solvent employed.

6. A process as claimed in claim 4, wherein the boron content is 2 to 50 p.p.m.

7. A process as claimed in any of the preceding claims, wherein the organic solvent is perchloroethylene.

8. A dry cleaning process substantially as described.

9. A corrosion-inhibiting composition for use in a process claimed in any of the preceding claims, comprising a liquid dry cleaning detergent having a pH of from 6 to 10 when determined as herein described, and having dissolved there in one or more esters and/or partial esters of boric acid to a total of 1 to 4% by weight.

10. A corrosion-inhibiting composition as claimed in claim 9, wherein the total is 2% by weight.

11. A corrosion-inhibiting composition as claimed in claim 9 or claim 10, wherein the said pH of the dry cleaning detergent is 7.5 to 8.5.

12. A corrosion-inhibiting composition as claimed in any of claims 9 to 11, wherein the ester or esters is or are selected from tristearyl borate, trihexylene glycol diborate, tri-di-isobutyl carbinyl borate, tri-n-butyl borate.

13. A corrosion-inhibiting composition as claimed in any one of claims 9 to 11, wherein the boric acid partial ester or partial esters is or are selected from sodium sorbitol borate, potassium sorbitol borate, sodium hexylene glycol borate, sodium glyceryl borate, sodium polyethylene glycol borate.

14. A dry cleaning liquid comprising an organic dry cleaning solvent, an organic boron compound dissolved therein and if desired a liquid dry cleaning detergent.

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